

5902
PENTODE
Five-Star Tube
★ ★ ★ ★ ★

FOR AF POWER AMPLIFIER APPLICATIONS

8-LEAD SUBMINIATURE
POWER OUTPUT—1 WATT

SHOCK, VIBRATION RATINGS
HEATER-CYCLING RATING

DESCRIPTION AND RATING

The 5902 is a subminiature beam power pentode for use as an audio-frequency power amplifier. In this application the tube is capable of delivering an output of approximately one watt.

The 5902 is a special-quality tube for use in critical industrial and military applications in which operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential

Heater Voltage, AC or DC	6.3±5%	Volts
Heater Current	0.45	Amperes

Direct Interelectrode Capacitances

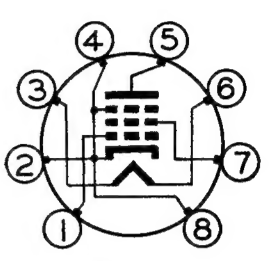
	With Shield*	Without Shield	
Grid-Number 1 to Plate	0.11	0.15	μμf
Input	6.5	6.5	μμf
Output	7.5	4.5	μμf

*With external shield of 0.405-inch inside diameter connected to cathode.

MECHANICAL

Mounting Position—Any
Envelope—T-3, Glass
Base—E8-10, Subminiature Button 8-Lead

BASING DIAGRAM

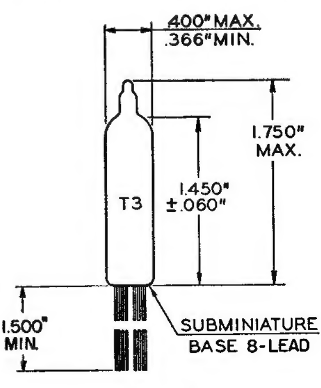


RETMA 8DL

TERMINAL CONNECTIONS

Lead 1—Grid Number 1
Lead 2—Cathode and Beam Plates
Lead 3—Heater
Lead 4—Cathode and Beam Plates
Lead 5—Plate
Lead 6—Heater
Lead 7—Grid Number 2 (Screen)
Lead 8—Cathode and Beam Plates

PHYSICAL DIMENSIONS



RETMA 3-3



Supersedes ET-T1099 dated 8-54

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES

Plate Voltage	165	Volts
Screen Voltage	155	Volts
Positive DC Grid-Number 1 Voltage	0	Volts
Negative DC Grid-Number 1 Voltage	55	Volts
Plate Dissipation	3.7	Watts
Screen Dissipation	0.4	Watts
DC Cathode Current	50	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	200	Volts
Heater Negative with Respect to Cathode	200	Volts
Bulb Temperature at Hottest Point	220	C

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

Plate Voltage	110	Volts
Screen Voltage	110	Volts
Cathode-Bias Resistor	270	Ohms
Peak AF Grid-Number 1 Voltage, RMS	6.4	Volts
Plate Resistance, approximate	15,000	Ohms
Transconductance	4200	Micromhos
Zero-Signal Plate Current	30	Milliamperes
Maximum-Signal Plate Current, approximate	29	Milliamperes
Zero-Signal Screen Current	2.2	Milliamperes
Maximum-Signal Screen Current	5.5	Milliamperes
Load Resistance	3000	Ohms
Total Harmonic Distortion, approximate	10	Percent
Maximum-Signal Power Output	1.0	Watts
Grid-Number 1 Voltage, approximate Ib=10 Microamperes	−40	Volts

CHARACTERISTICS LIMITS

		Minimum	Maximum	
Heater Current Ef=6.3 volts	Initial	420	480	Milliamperes
	500-Hr	414	492	Milliamperes
Plate Current Ef=6.3 volts, Eb=110 volts, Ec2=110 volts, Rk=270 ohms (by-passed)	Initial	23.0	37.0	Milliamperes
Screen Current Ef=6.3 volts, Eb=110 volts, Ec2=110 volts, Rk=270 ohms (by-passed)	Initial	0	4.0	Milliamperes
Transconductance Ef=6.3 volts, Eb=110 volts, Ec2=110 volts, Rk=270 ohms (by-passed)	Initial	3500	4900	Micromhos
Plate Resistance Ef=6.3 volts, Eb=110 volts, Ec2=110 volts, Rk=270 ohms (by-passed)	Initial	0.01	....	Megohms
Power Output (1) Ef=6.3 volts, Eb=110 volts, Ec2=110 volts, Rk=270 ohms (by-passed), RL=3000 ohms, Esig=6.4 volts RMS	Initial	0.75	....	Watts
Power Output Change with Heater Voltage Difference between Power Output (1) and Power Output at Ef=5.7 volts (other conditions the same) expressed as a percentage of Power Output (1)	Initial	....	15	Percent
	500-Hr	....	15	Percent
Power Output Change with Operation Difference between Power Output (1) initially and after operation expressed as a percentage of initial value	500-Hr	....	20	Percent

CHARACTERISTICS LIMITS CONTINUED ON PAGE 3

CHARACTERISTICS LIMITS (Cont'd)

		Minimum	Maximum	
Average Power Output Change with Operation				
Average of values for "Power Output Change with Operation"	500-Hr	....	15	Percent
Plate Current Cutoff				
Ef = 6.3 volts, Ebb = 110 volts, Ec2 = 110 volts, Ec1 = −40 volts	Initial	....	100	Microamperes
Interelectrode Capacitances				
Grid-Number 1 to Plate (g1 to p)	Initial	....	0.20	μμf
Input (g1 to h, k, g2)	Initial	5.5	7.5	μμf
Output (p to h, k, g2)	Initial	6.5	8.5	μμf
Measured with external shield of 0.405-inch inside diameter connected to cathode.				
Negative Grid-Number 1 Current				
Ef = 6.3 volts, Eb = 110 volts, Ec2 = 110 volts, Rg1 = 1.0 meg, Rk = 270 ohms	Initial	....	1.0	Microamperes
	500-Hr	....	2.0	Microamperes
Heater-Cathode Leakage Current				
Ef = 6.3 volts, Ehk = 100 volts				
Heater Positive with Respect to Cathode	Initial	....	15	Microamperes
	500-Hr	....	60	Microamperes
Heater Negative with Respect to Cathode	Initial	....	15	Microamperes
	500-Hr	....	60	Microamperes
Interelectrode Leakage Resistance				
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results				
Grid-Number 1 to All at 100 Volts DC	Initial	50	....	Megohms
	500-Hr	25	....	Megohms
Plate to All at 300 Volts DC	Initial	50	....	Megohms
	500-Hr	25	....	Megohms
Vibrational Noise Output Voltage, RMS				
Ef = 6.3 volts, Ebb = 110 volts, Ec2 = 110 volts, Rk = 270 ohms (by-passed), R_L = 2000 ohms, Vibrational acceleration = 15 G at 40 cps	Initial	....	100	Millivolts
Grid-Number 1 Emission Current				
Ef = 7.5 volts, Eb = 110 volts, Ec2 = 110 volts, Ecc1 = −40 volts, Rg1 = 1.0 meg	Initial	....	2.0	Microamperes

The indicated 500-hour values are life-test end points for the following conditions of operation: Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 220 ohms, Rg1 = 0.47 meg, Ehk = 200 volts with heater positive with respect to cathode, and bulb temperature = 220 C minimum.

SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for one hour to evaluate and control initial variations in power output.

Survival Rate Life Test
Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical inoperatives.

Heater-Cycling Life Test
Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and four minutes off, Eb = Ec2 = Ec1 = 0 volts, and Ehk = 140 volts RMS.

Shock Rating—450 G
Statistical sample subjected to five impact accelerations of 450 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating—2.5 G
Statistical sample subjected to vibrational acceleration of 25 G for 32 hours minimum in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

In the design of military equipment employing this tube, reference should be made to the appropriate MIL-E-1 specification.

AVERAGE PLATE CHARACTERISTICS

DECEMBER 14, 1956

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E_f = 6.3 VOLTS
E_{c2} = 110 VOLTS

I_b @ E_{c1} = +20 VOLTS
I_{c1} @ E_{c1} = +20 VOLTS
+16
+12
+8.0
+4.0
+16
+12
+8.0
+4.0
0
−4.0
−8.0
−12
I_{c2} @ E_{c1} = +20 VOLTS
+16
+8.0
0

PLATE (I_b) OR SCREEN (I_{c2}) CURRENT IN MILLIAMPERES: 0, 100, 200, 300, 400

GRID-NUMBER 1 CURRENT IN MILLIAMPERES: 0, 20, 40, 60, 80, 100

PLATE VOLTAGE IN VOLTS: 0, 50, 100, 150, 200, 250

DECEMBER 14, 1956

AVERAGE TRANSFER CHARACTERISTICS

E_f = 6.3 VOLTS
E_b = 110 VOLTS

E_{c2} = 125 VOLTS
110
100
75
50

PLATE CURRENT IN MILLIAMPERES: 0, 20, 40, 60, 80, 100

GRID-NUMBER 1 VOLTAGE IN VOLTS: −28, −24, −20, −16, −12, −8, −4, 0

DECEMBER 14, 1956



AVERAGE TRANSFER CHARACTERISTICS

E_f = 6.3 VOLTS
E_b = 110 VOLTS

E_{c2} = 125 VOLTS, 110, 100, 75, 50

SCREEN CURRENT IN MILLIAMPERES

10, 8, 6, 4, 2, 0

−28, −24, −20, −16, −12, −8, −4, 0

GRID-NUMBER 1 VOLTAGE IN VOLTS

DECEMBER 14, 1956

AVERAGE TRANSFER CHARACTERISTICS

E_f = 6.3 VOLTS
E_b = 110 VOLTS

E_{c2} = 125 VOLTS, 110, 100, 75, 50

TRANSCONDUCTANCE IN MICROMHOS

7000, 6000, 5000, 4000, 3000, 2000, 1000, 0

−40, −30, −20, −10, 0

GRID-NUMBER 1 VOLTAGE IN VOLTS

DECEMBER 14, 1956